

Application No. 10/578,737
Paper Dated: November 17, 2009
In Reply to USPTO Correspondence of August 18, 2009
Attorney Docket No. 1455-061439

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims

1-82. (Cancelled)

83. (Currently Amended) A cold rolled steel sheet having aging resistance and excellent formability, comprising in weight %: 0.003 % or less of C; 0.005 ~ 0.03 % of S; 0.01 ~ 0.1 % of Al; 0.02 % or less of N; ~~0.2 % or less~~ 0.03 ~ 0.2% of P; 0.05 ~ 0.2 % of Mn; and the balance of Fe and other unavoidable impurities, wherein a composition of Mn and S satisfies the relationship: $0.58 * \text{Mn} / \text{S} \leq 10$, and wherein the steel sheet comprises precipitates of MnS having an average size of 0.2 μm or less.

84. (Cancelled)

85. (Previously Presented) The steel sheet as set forth in claim 83, wherein the steel sheet comprises 0.004 % or less of N.

86. (Cancelled)

87. (Previously Presented) The steel sheet as set forth in claim 83, further comprising at least one of 0.1 ~ 0.8 % of Si and 0.2 ~ 1.2 % of Cr.

88. (Previously Presented) The steel sheet as set forth in claim 83, wherein the steel sheet comprises 0.005 ~ 0.02 % of N and 0.03 ~ 0.06 % of P.

89. (Previously Presented) The steel sheet as set forth in claim 88, wherein the composition of Al and N satisfies the relationship: $1 \leq 0.52 * \text{Al} / \text{N} \leq 5$.

90. (Previously Presented) The steel sheet as set forth in claim 83, further comprising 0.01 ~ 0.2 % of Mo.

91. (Previously Presented) The steel sheet as set forth in claim 87, further comprising 0.01 ~ 0.2 % of Mo.

92. (Previously Presented) The steel sheet as set forth in claim 83, further comprising 0.01 ~ 0.2% of V.

93. (Previously Presented) The steel sheet as set forth claim 87, further comprising 0.01 ~ 0.2 % of V.

94. (Previously Presented) The steel sheet as set forth in claim 91, further comprising 0.01 ~ 0.2% of V.

95. (Currently Amended) A cold rolled steel sheet having aging resistance and ~~excellent formability~~, comprising in weight %: 0.0005 ~ 0.003 % ~~or less~~ of C; 0.003 ~ 0.025 % of S; 0.01 ~ 0.08 % of Al; 0.02 % or less of N; 0.2 % or less of P; 0.01 ~ 0.2 % of Cu; and the balance of Fe and other unavoidable impurities, wherein a composition of Cu and S satisfies the relationship: $1 \leq 0.5 \times \text{Cu}/\text{S} \leq 10$, and wherein the steel sheet comprises precipitates of CuS having an average size of 0.1 μm or less.

96. (Previously Presented) The steel sheet as set forth in claim 95, wherein the steel sheet comprises 0.015 % or less of P.

97. (Previously Presented) The steel sheet as set forth in claim 95, wherein the steel sheet comprises 0.004 % or less of N.

98. (Previously Presented) The steel sheet as set forth in claim 95, wherein the composition of Cu and S satisfies the relationship: $1 \leq 0.5 \times \text{Cu}/\text{S} \leq 3$.

99. (Previously Presented) The steel sheet as set forth in claim 95, wherein the steel sheet comprises 0.03 ~ 0.2 % or less of P.

100. (Previously Presented) The steel sheet as set forth in claim 95, further comprising at least one of 0.1 ~ 0.8 % of Si and 0.2 ~ 1.2 % of Cr.

101. (Previously Presented) The steel sheet as set forth in claim 95, wherein the steel sheet comprises 0.005 ~ 0.02 % of N and 0.03 ~ 0.06 % of P.

102. (Previously Presented) The steel sheet as set forth in claim 101, wherein the composition of Al and N satisfies the relationship: $1 \leq 0.52 \times \text{Al}/\text{N} \leq 5$.

103. (Previously Presented) The steel sheet as set forth in claim 95, further comprising 0.01 ~ 0.2 % of Mo.

104. (Previously Presented) The steel sheet as set forth in claim 100, further comprising 0.01 ~ 0.2 % of Mo.

105. (Previously Presented) The steel sheet as set forth in claim 95, further comprising 0.01 ~ 0.2% of V.

106. (Previously Presented) The steel sheet as set forth claim 100, further comprising 0.01 ~ 0.2 % of V.

107. (Previously Presented) The steel sheet as set forth in claim 104, further comprising 0.01 ~ 0.2% of V.

108. (Currently Amended) A cold rolled steel sheet having aging resistance and excellent formability, comprising in weight %: 0.0005 ~ 0.003 % or less of C; 0.003 ~ 0.025 % of S; 0.01 ~ 0.08 % of Al; 0.02 % or less of N; 0.2 % or less of P; 0.03 ~ 0.2 % of Mn; 0.005 ~ 0.2 % of Cu; and the balance of Fe and other unavoidable impurities, wherein a composition of Mn, Cu, and S satisfies the relationship: $Mn+Cu \leq 0.3$ and $2 \leq 0.5*(Mn+Cu)/S \leq 20$, and wherein the steel sheet includes precipitates of MnS, CuS, and (Mn, Cu)S having an average size of 0.2 μm or less.

109. (Previously Presented) The steel sheet as set forth in claim 108, wherein the steel sheet comprises 0.015 % or less of P.

110. (Previously Presented) The steel sheet as set forth in claim 108, wherein the steel sheet comprises 0.004 % or less of N.

111. (Previously Presented) The steel sheet as set forth in claim 108, wherein the number of precipitates is 2×10^6 or more.

112. (Previously Presented) The steel sheet as set forth in claim 108, wherein the composition of Mn, Cu and S satisfies the relationship: $2 \leq 0.5*(Mn+Cu)/S \leq 7$.

113. (Previously Presented) The steel sheet as set forth in claim 112, wherein the number of precipitates is 2×10^8 or more.

114. (Previously Presented) The steel sheet as set forth in claim 112, wherein the steel sheet comprises 0.03 ~ 0.2 % or less of P.

115. (Previously Presented) The steel sheet as set forth in claim 112, further comprising at least one of 0.1 ~ 0.8 % of Si and 0.2 ~ 1.2 % of Cr.

116. (Previously Presented) The steel sheet as set forth in claim 112, wherein the steel sheet comprises 0.005 ~ 0.02 % of N and 0.03 ~ 0.06 % of P.

117. (Previously Presented) The steel sheet as set forth in claim 116, wherein the composition of Al and N satisfies the relationship: $1 \leq 0.52 * \text{Al}/\text{N} \leq 5$.

118. (Previously Presented) The steel sheet as set forth in claim 108, further comprising 0.01 ~ 0.2 % of Mo.

119. (Previously Presented) The steel sheet as set forth in claim 115, further comprising 0.01 ~ 0.2 % of V.

120. (Previously Presented) The steel sheet as set forth in claim 108, further comprising 0.01 ~ 0.2% of V.

121. (Previously Presented) The steel sheet as set forth in claim 115, further comprising 0.01 ~ 0.2 % of V.

122. (Previously Presented) The steel sheet as set forth in claim 118, further comprising 0.01 ~ 0.2% of V.

123. (Withdrawn) A method of manufacturing a cold rolled steel sheet having aging resistance and excellent formability, comprising the steps of: hot-rolling a steel slab with finish rolling at an Ar_3 transformation temperature or more to provide a hot rolled steel sheet, after reheating the steel slab to a temperature of 1,100 °C or more, the steel slab comprising in weight %: 0.003 % or less of C; 0.005 ~ 0.03 % of S; 0.01 ~ 0.1 % of Al; 0.02 % or less of N; 0.2 % or less of P; 0.05 ~ 0.2 % of Mn; and the balance of Fe and other unavoidable impurities, wherein a composition of Mn and S satisfies the relationship: $0.58 * \text{Mn}/\text{S} \leq 10$; cooling the steel

sheet at a speed of 200 °C/min or more; coiling the cooled steel sheet at a temperature of 700 °C or less and then cold rolling the steel sheet; and continuous annealing the cold rolled steel sheet so as to obtain a cold rolled steel sheet comprising MnS precipitates having an average size of 0.2 μ m or less.

124. (Withdrawn) The method as set forth in claim 123, wherein the steel slab comprises 0.015 % or less of P.

125. (Withdrawn) The method as set forth in claim 123, wherein the steel slab comprises 0.004 % or less of N.

126. (Withdrawn) The method as set forth in claim 123, wherein the steel slab comprises 0.03 ~ 0.2 % of P.

127. (Withdrawn) The method as set forth in claim 123, wherein the steel slab further comprises at least one of 0.1 ~ 0.8 % of Si and 0.2 ~ 1.2 % of Cr.

128. (Withdrawn) The method as set forth in claim 123, wherein the steel slab comprises 0.005 ~ 0.02 % of N and 0.03 ~ 0.06 % of P.

129. (Withdrawn) The method as set forth in claim 128, wherein the composition of Al and N satisfies the relationship: $1 \leq 0.52 * Al/N \leq 5$.

130. (Withdrawn) The method as set forth in claim 123, wherein the steel slab further comprises 0.01 ~ 0.2 % of Mo.

131. (Withdrawn) The method as set forth in claim 127, wherein the steel slab further comprises 0.01 ~ 0.2 % of Mo.

132. (Withdrawn) The method as set forth in claim 123, wherein the steel slab further comprises 0.01 ~ 0.2% of V.

133. (Withdrawn) The method as set forth in claim 127, wherein the steel slab further comprises 0.01 ~ 0.2 % of V.

134. (Withdrawn) The method as set forth in claim 131, wherein the steel slab further comprises 0.01 ~ 0.2% of V.

135. (Withdrawn) A method of manufacturing a cold rolled steel sheet having aging resistance and excellent formability, comprising the steps of: hot-rolling a steel slab with finish rolling at an Ar_3 transformation temperature or more to provide a hot rolled steel sheet, after reheating the steel slab to a temperature of 1,100 °C or more, the steel slab comprising in weight %: 0.0005 ~ 0.003 % of C; 0.003 ~ 0.025 % of S; 0.01 ~ 0.08 % of Al; 0.02 % or less of N; 0.2 % or less of P; 0.01 ~ 0.2 % of Cu; and the balance of Fe and other unavoidable impurities, wherein a composition of Cu and S satisfies the relationship: $1 \leq 0.5 \times Cu/S \leq 10$; cooling the steel sheet at a speed of 300 °C/min; coiling the cooled steel sheet at a temperature of 700 °C or less and then cold rolling the wound steel sheet; and continuous annealing the cold rolled steel sheet so as to obtain a cold rolled steel sheet comprising CuS precipitates having an average size of 0.2 μm or less.

136. (Withdrawn) The method as set forth in claim 135, wherein the steel slab comprises 0.015 % or less of P.

137. (Withdrawn) The method as set forth in claim 135, wherein the steel slab comprises 0.004 % or less of N.

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138. (Withdrawn) The method as set forth in claim 135, wherein the composition of Cu and S satisfies the relationship: $1 \leq 0.5 \times \text{Cu}/\text{S} \leq 3$.

139. (Withdrawn) The method as set forth in claim 135, wherein the steel slab comprises 0.03 ~ 0.2 % or less of P.

140. (Withdrawn) The method as set forth in claim 135, wherein the steel slab further comprises at least one of 0.1 ~ 0.8 % of Si and 0.2 ~ 1.2 % of Cr.

141. (Withdrawn) The method as set forth in claim 135, wherein the steel slab comprises 0.005 ~ 0.02 % of N and 0.03 ~ 0.06 % of P.

142. (Withdrawn) The method as set forth in claim 141, wherein the composition of Al and N satisfies the relationship: $1 \leq 0.52 \times \text{Al}/\text{N} \leq 5$.

143. (Withdrawn) The method as set forth in claim 135, wherein the steel slab further comprises 0.01 ~ 0.2 % of Mo.

144. (Withdrawn) The method as set forth in claim 140, wherein the steel slab further comprises 0.01 ~ 0.2 % of Mo.

145. (Withdrawn) The method as set forth in claim 135, wherein the steel slab further comprises 0.01 ~ 0.2% of V.

146. (Withdrawn) The method as set forth in claim 143, further comprising 0.01 ~ 0.2 % of V.

147. (Withdrawn) The method as set forth in claim 144, wherein the steel slab further comprises 0.01 ~ 0.2% of V.

148. (Withdrawn) A method of manufacturing a cold rolled steel sheet having aging resistance and excellent formability, comprising the steps of: hot-rolling a steel slab with finish rolling at an Ar_3 transformation temperature or more to provide a hot rolled steel sheet, after reheating the steel slab to a temperature of 1,100 °C or more, the steel slab comprising in weight %: 0.0005 ~ 0.003 % of C; 0.003 ~ 0.025 % of S; 0.01 ~ 0.08 % of Al; 0.02 % or less of N; 0.2 % or less of P; 0.03 ~ 0.2 % of Mn; 0.005 ~ 0.2 % of Cu; and the balance of Fe and other unavoidable impurities, wherein a composition of Mn, Cu, and S satisfies the relationships: $Mn+Cu \leq 0.3$ and $2 \leq 0.5*(Mn+Cu)/S \leq 20$; cooling the steel sheet at a speed of 300 °C/min; coiling the cooled steel sheet at a temperature of 700 °C or less and then cold rolling the wound steel sheet; and continuous annealing the cold rolled steel sheet so as to obtain a cold rolled steel sheet comprising MnS, CuS, (Mn, Cu)S precipitates having an average size of 0.2 μ m or less.

149. (Withdrawn) The method as set forth in claim 148, wherein the steel slab comprises 0.015 % or less of P.

150. (Withdrawn) The method as set forth in claim 148, wherein the steel slab comprises 0.004 % or less of N.

151. (Withdrawn) The method as set forth in claim 148, wherein the number of precipitates is 2×10^6 or more.

152. (Withdrawn) The method as set forth in claim 148, wherein the composition of Mn, Cu and S satisfies the relationship: $2 \leq 0.5*(Mn+Cu)/S \leq 7$.

153. (Withdrawn) The method as set forth in claim 152, wherein the number of precipitates is 2×10^8 or more.

154. (Withdrawn) The method as set forth in claim 148, wherein the steel slab comprises 0.03 ~ 0.2 % or less of P.

155. (Withdrawn) The method as set forth in claim 148, wherein the steel slab further comprises at least one of 0.1 ~ 0.8 % of Si and 0.2 ~ 1.2 % of Cr.

156. (Withdrawn) The method as set forth in claim 148, wherein the steel slab comprises 0.005 ~ 0.02 % of N and 0.03 ~ 0.06 % of P.

157. (Withdrawn) The method as set forth in claim 156, wherein the composition of Al and N satisfies the relationship: $1 \leq 0.52 * \text{Al}/\text{N} \leq 5$.

158. (Withdrawn) The method as set forth in claim 148, wherein the steel slab further comprises 0.01 ~ 0.2 % of Mo.

159. (Withdrawn) The method as set forth in claim 155, wherein the steel slab further comprises 0.01 ~ 0.2 % of Mo.

160. (Withdrawn) The method as set forth in claim 148, wherein the steel slab further comprises 0.01 ~ 0.2% of V.

161. (Withdrawn) The method as set forth claim 155, wherein the steel slab further comprises 0.01 ~ 0.2 % of V.

162. (Withdrawn) The method as set forth in claim 159, wherein the steel slab further comprises 0.01 ~ 0.2% of V.

163. (Previously Presented) The steel sheet as set forth in claim 92, wherein the composition of V and C satisfies the relationship: $1 \leq 0.25 * \text{V}/\text{C} \leq 20$.

164. (Previously Presented) The steel sheet as set forth in claim 105, wherein the composition of V and C satisfies the relationship: $1 \leq 0.25*V/C \leq 20$.

165. (Previously Presented) The steel sheet as set forth in claim 120, wherein the composition of V and C satisfies the relationship: $1 \leq 0.25*V/C \leq 20$.

166. (Withdrawn) The method as set forth in claim 132, wherein the composition of V and C satisfies the relationship: $1 \leq 0.25*V/C \leq 20$.

167. (Withdrawn) The method as set forth in claim 145, wherein the composition of V and C satisfies the relationship: $1 \leq 0.25*V/C \leq 20$.

168. (Withdrawn) The method as set forth in claim 160, wherein the composition of V and C satisfies the relationship: $1 \leq 0.25*V/C \leq 20$.